Water distribution in martian subsurface using of the passive neutron method: from DAN to ADRON-RM on ExoMars 2020

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In our study we will provide science capability of natural neutron background measurements at the surface of Mars, which is produced by galactic cosmic rays (GCR) in Martian subsurface and named as passive measurements. The presence of hydrogen significantly influences on neutron leakage spectrum due to effective neutron moderation and final thermalization via collisions with hydrogen nuclei. As a result, the variations of neutron flux detected onboard in different energy bands correlate with subsurface hydrogen/water abundance.

During more than 6 years MSL Curiosity is successfully traversing across Mars surface with the Dynamic Albedo of Neutron (DAN) instrument installed onboard. Next year is planned to be launched ExoMars Rover with the ADRON-RM instrument onboard which was designed on the principles of the DAN instrument. The ADRON-RM experiment is the next implementation of nuclear methods for the exploration of Mars. The DAN measurements in the passive mode strongly depend on MMRTG power system (autonomous source of electricity and heat based on decay of natural radioactive isotope). It generates considerable neutron background in wide energy range. The ExoMars rover neutron background is much smaller because its primary electricity will be generated by the solar panels and only small Radioisotope Heat Units (RHU) will be used to provide thermal stabilization of the entire system. It generates at least 100 times less neutron background As a result the GCR neutrons will dominate in ADRON-RM measured signal.

We will provide method overview and last results of the data gathered from the DAN instrument and the expected results how measurement capabilities of ADRON-RM could be evaluated through the DAN passive data.